UNBOUND NOTES AND DRAWINGS

1885

Number 1
Jan 20 - 1885

Experiment on secondary batteries

ordinary Plantè cell - plates 2" × 3½"
⅛" apart - 3 cells used each consisting of 6 plates - 3 + & 3 -. H_2SO_4 of 10%

Cells charged in multiple arc in series with 3 - 16 c.p. lamps also in multiple arc at dull red.

Action gradual - plates looked uniform.

Charged for 2 hours and then discharged through lamp of 1 c.p. requiring about 4 volts to bring it up to candle power. (cells in series)

The lamp was very bright for an instant - then fell to dull red and went out in 2 minutes

Recharged in series and in opposite direction for 2 hours at about same rate as before.

Lamp was very bright for 3 minutes - dull red for 2 minutes and then went out

Plates were alternately + & -.

Also tried the following arrangement
For the positive a stick of dense carbon and the negative a cylinder of perforated zinc.
The solution is composed of
½ Sat. Sol sulphate of Zinc
½ " " " " Manganese.

Charged for 4 hours with current from 2-16 c.p. lamps (in multiple arc) 3 cells in series.

Lamp used in discharge same as before - dull red for 30 minutes.

Battery appears fairly constant but I think internal resistance too high - carbon should be more porous to allow more surface for the oxide of manganese to form.

Jan 31
Recharged lead battery with one lamp at about 12 c.p. in series (cells 3 in series).

After 2 hours charge, ran lamp for 5 minutes - very bright at first but fell rapidly.

Tried 2 cells lead battery in series. Charged ab 3/4 hour and ran lamp bright red for 5 minutes.

Experiment on porosity of different special carbons.

Samples soaked in water for 44 hours and gain of weight taken.

½ Sago
Before = 53.000 Gms
after = 112.000 "
Gain % = 112

2 Wheat Flour
Before = 30.000 "
after = 63.000 "
Gain % = 110

3 White Indian Meal
Before = 45.000 "
after = 92.000
Gain % = 104½

4 Rye Flour
Before = 33.000 "
after = 56.000 "
Gain % = 69½

5 Yellow Indian Meal
Before = 15.000 Gms
After = 26.000 "
Gain o/o = 73 7/10

6 Coffee
Before = 1.500 "
After = 3.000 "
Gain o/o = 100

7 Buckwheat
Before = 27.000 "
After = 55.000 "
Gain o/o = 103 7/10

8 Oat Meal
Before = 44.000 "
After = 75.000 "
Gain o/o = 70 1/2

Feb 2.
Recharged lead battery 1 hr 4 hours - ran fairly for 5 minutes

Tried battery of Zinc and Carbon plates in Iodide of Potassium but it does not form a success.

Iodide of Copper forms on Copper plate and is dissolved by Potassium Iodide.
From this the Copper is reduced by the Zinc plate leaving Zinc Iodide in the solution from which the Zinc is at once precipitated by Potassium salt.

Copper & Zinc plates in solution of Iodide of Zinc gave good result on a very rough test.

Feb. 3.
Made battery on this principle with same arrangement of plates as lead battery.
Very slight current must be used in charging or else Zinc comes down too fast and both falls away and short circuits the plates.

After 2 hours charge - ran lamp good red heat for 10 minutes and kept it perceptably red for 30.

Appears to be improved by addition of Zinc sulphate.

E. M. F is good and resistance low but keeps getting short circuited by shoots of metal from zinc plate.

Feb 4.

Made battery of zinc-carbon in zinc & Manganese sulphate.

Carbon was a rod of dense carbon in flannel bag surrounded by fine charcoal.

Is not good for any thing.

Made zinc-sulphur in zinc sulphide with flannel bitumen plate in order to prevent short circuits but found the metal crept through it

Feb 5.

In zinc-carbon battery replaced carbon by lead cylinder perforated and full of spongy lead.

Poor result - probably too much local action in spongy lead.

Also replaced carbon stick by stick of carbon surrounded by

pulverized carbonized anthracite and found result about same as with lead electrode.

Tried small battery of plates of Copper and Cadmium in Iodide of Cadmium also sulphate-bromid and mixture of the three - also same acid with acetic.

Result fair but not promising as free Iodine forms.

Repeated experiment with Copper and Zinc in Iodid of Zinc and with acetic. Copper plate in mesh to allow surface for Iodine to act.

Very good result on rough experiment.

Charged with one cell for 30 minutes gave constant 2 M.A. for 15 minutes, then fell and again remained constant for 10 minutes and then was used up.

In solution of sulphate of Zinc and Manganese, tried the following.

№ 1 = Plate of Zinc & Carbon
" 2 = " Zinc and Zinc and Manganese oxide
" 3 = " " & pieces cut of fine Carbon
" 4 = " " & Lead
" 5 = " " & Tin
" 6 = " " & Iron
" 7 = " " & Cadmium
" 8 = " " & Copper
" 9 = " " & pieces cut of fine carbon
" 10 = " " & Antimony
" 11 = " " & pieces cut of red Lead
" 12 = " " & Brass.

Charged for 1 hour in series,
Discharge

№ 1 =	150	№ 7 =	0
" 2 =	0	" 8 =	100
" 3 =	0	" 9 =	100
" 4 =	25	" 10 =	35
" 5 =	15	" 11 =	15
" 6 =	15	" 12 =	140

№ 1 & 9 lasted 30 minutes
" 8 & 12 " 5 "

With same solution also tried,

Plate of Zinc & porous cup of plumbago.
action fair

Plate of Zinc and porous cup of oxide of Iron (magnetic)
good action but falls away rapidly

Plate of Zinc and Platinum.
Very strong action for an instant;

Changed following in series.

№ 1 = Salivalid Iodide of Zinc
" 2 = Do Lute " " "
" 3 = Salivalid " " + acetic acid
" 4 = Do Lute " " " " " "
" 5 = Iodide + Sulphate Zinc + Sulph Manganese
" 6 = Iodide Zinc + acetate of Cobalt
" 7 = acetate of Zinc
" 8 = " " " + Iodide of Zinc
" 9 = Sulph Aluminium, Iodide Zinc + acetic acid
" 10 = Iodide Zinc + alcohol
" 11 = " " + Sulphate Cadmium
" 12 = " " + Iron Ammonium Citrate

Deflections after 30 minutes charge

№ 1	= 30	№ 7	= 10
" 2	= 10	" 8	= 30
" 3	= 40	" 9	= 20
" 4	= 10	" 10	= 10
" 5	= 60	" 11	= 25
" 6	= 10	" 12	= 10

Made large battery with Zinc + Copper plates with Solution of Iodide of Zinc - Sulphate of Zinc and Sulphate of Manganese.

5 cells of this battery will run the lamp at bright red but the battery has several faults.

The E.M.F is low.

The deposits are not firm and are liable to fall away.

When charged the copper plate becomes coated with a white deposit probably Iodide of Copper.

In discharge this is not entirely reduced and a black coat of Iodide remains. After one or two charges this cracks and falls off spoiling the solution.

Third plate of
Zinc & Lead in Iodide of Lead
Copper " " " " " "
Zinc " Iron " " " Iron
Copper " " " " " "

Results very poor and the Iron solution very nasty to handle.

Made large battery for practical test of Iodide Solutions.

Battery consisted of large flattened cylinder of Sheet Copper in centre of which was suspended a plate of perforated amalgamated Zinc

The Copper plate was coated with electro deposited copper to give sponge surface.

Solution

½ Sulphate of Zinc saturated
½ Iodide " " "

slightly acid with acetic acid.

Charged 5 cells in series for 4 hours.

Brought lamp to bright red for 30 minutes and then fell off rapidly

Tried special test of small cells as follows.

No 1 solution of Iodide of Zinc
Sulphate " "
" " Manganese

N° 2 Solution of Sulphate of Zinc
" " Manganese.

Copper and Zinc plates used in both.

Discharge after charging 1 hour.
N° 1 50 for an instant
35 " 15 minutes
30 " 2 "
Then fell off slowly and was entirely discharged in 30 minutes.

N° 2 = 30 for an instant
20 " 10 minutes
at this point the deposit fell off and the action ceased

Tried Zinc + Carbon in Iodide of Zinc but the result is same as free Iodine forms

Tried Copper and Mercury in solution of Zinc Iodide & Sulphate.
Not very promising

Tried same electrodes in sulphate of Copper - No action.

Number 2

Battery composed of two copper plates in acid solution of Zinc iodide gives good E. M. F. at first but is not at all constant. Iodide of copper forms on one plate and metallic Zinc on the other.

There is a slight primary action between copper and Zinc in solution of Iodide of Zinc either neutral, acid or mixed with Sulphate of Zinc, and the copper becomes coated with a black deposit.

Neither Zinc nor Copper alone, caused any deposit.

In order to stop the initial primary action the Zinc was amalgamated but this did not effect the object and made no difference in the final action except that the deposit was made more uniform and less spongy metal formed.

With both the plates amalgamated there is no primary action and the battery will not change at all

Experiment with Copper and Zinc plates in solution consisting of
200 c.c of water - 1 gramm Iodide of Zinc, and the following

N° 1 = + Citric acid
" 2 = + Acetic "
" 3 = + 2 gramm Sulphate of Zinc & Citric acid
" 4 = + " " " " " & Acetic "
" 5 = + 1 " Chromic acid
" 6 = + Nitrate of Cobalt & Citric "
" 7 = + 1 gramm Chromic Sulphate
" 8 = + 1 " Chloride of Cobalt
" 9 = + 1 " Iodide " Cadmium
" 10 = + 1 " Acetate " Cobalt
" 11 = + 1 " Pyrogallic acid
" 12 = + 1 " Sugar

Charged for 45 minutes in series.
Discharged through galvanometer and obtained the following deflections

N° 1 = 30	N° 7 = 40
" 2 = 28	" 8 = 50
" 3 = 50	" 9 = 20
" 4 = 50	" 10 = 20
" 5 = 15	" 11 = 10
" 6 = 40	" 12 = 15

Number 3.

Tried a battery in which the electrodes were a cylinder of zinc amalgamated and a porous cup filled with bits of carbonized anthracite.

The solution was mixed sulphate of zinc and manganese - half and half - saturated.

Three cells of this in series will run the lamp at good candle power, but when large enough to last for any length of time, weighs too much.

The lead battery first mentioned after repeated charging and discharging and after the plates had been subjected to electrolytic action in a solution of Litharge in caustic soda - ran the lamp at full candle power for 30 minutes, with one hour's charging.

Constructed a battery as follows. In a tube of copper was placed a solution of ½ Iodide of zinc ⅓ sulphate of zinc + ⅙ sulphate of manganese - all saturated.

In this was suspended a rod of amalgamated zinc.

Six cells in series will give about 20 minutes at full candle power with two hours charging.

The object of this experiment was to construct a battery in which the vessel containing the solution should be one of the elements of the battery and this could be done very well as the action is nearly all on the surface of the copper. The battery weighed about five pounds.

Tried battery of copper and zinc plates in solution of caustic Soda. High electromotive force at first, but falls rapidly.

Tried battery of mixed sulphate of zinc and manganese in which the electrodes were a plate of amalgamated zinc and a piece of porous sago Carbon. This gives very fair results

but would have to be quite bulky to run the lamp for several hours.

Summary.

I shall here discuss the three batteries which of all those tried have proved the best and they will be mentioned in the order of their comparative values.

1. ordinary Plante cell.

Plates should be cleaned with sand paper and left 24 hours in very dilute Nitric acid.

Then connected up, washed with clean water and exposed to the action of a strong current in a solution of Litharge in caustic Soda; the direction of the current being several times reversed.

Remove from this and wash to remove all traces of the alkaline solution and then charge in dilute sulphuric acid (about 10 %). Plates must be charged and discharged and recharged with a reverse current 4 or 4.

and the percentage of acid should be from time to time increased till it is about 20.

The object is to have the action strike in as far as possible in order that the plates may take a good charge. The actual result is, that about the time the battery is good for any thing, the plates are ready to fall to pieces. This means that if you would have a good number of lamp hours from the battery you must increase the surface of the plates and this of course means increase of weight.

2 Zinc and Carbon battery.

The best solution for this is

1/2 Sulphate of Zinc saturated.
1/2 " Manganese "

The Zinc should be amalgamated and the Carbon should be porous.

If you attempt to use bits of anthracite or other Carbon they should be packed in a porous

cup rather than a bag as a bag is apt to stretch and allow the plates to separate.

If a porous carbon, as sago, is used the pores are apt to become clogged and for this reason the charging should be as slow as possible.

The carbon is of course the oxygen pole in charging.

Zinc and Copper battery.

Best solution is

1/2 Iodide of Zinc saturated.
1/2 Sulphate " "
1/6 " Manganese "

and a few drops of Nitric or acetic acid.

The Zinc should be amalgamated and the Copper be plated with Copper to secure a spongy surface.

The Copper is the oxygen pole.

The battery must be charged

slowly and is not easy to manage as a slight change in the making of the solution or too strong a current in charging spoils it.

Free Iodine forms slowly and this means away the zinc plate.

All of the batteries are open to one serious objection.
During the process of charging deposits form on the plates.
A slight shaking causes these deposits to fall away and when this happens the action at once stops and the solution must be renewed and the battery cleaned.

A primary battery will stand any amount of shaking and is indeed improved by it as the evolved gases are prevented from sticking to the electrodes.

Mar 8/85

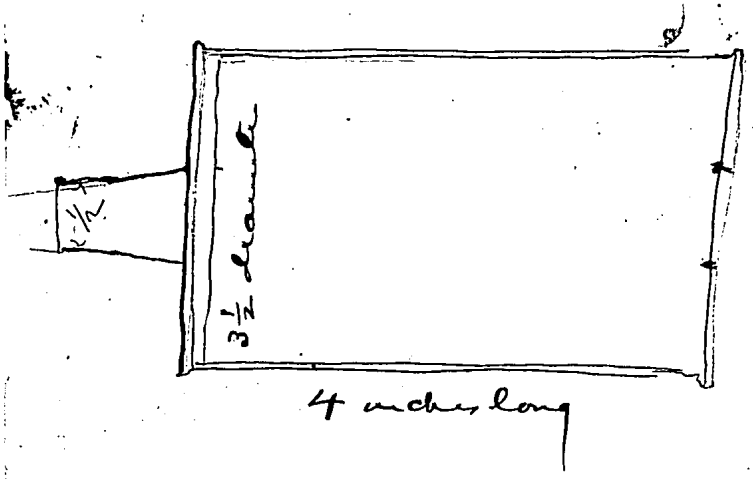
Thomas P. Conant.

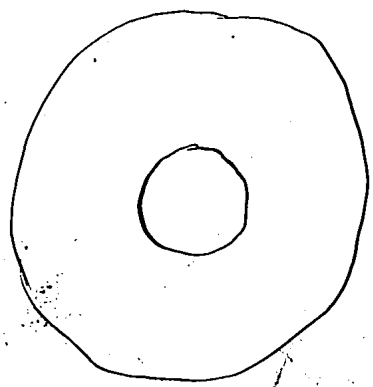
THOMAS A. EDISON,
Central Station, Construction Dep't,
No. 65 FIFTH AVENUE,

Form L. 1000-4-21-'84.

New York, July 6 1881

6 of this size





also 6 of 3½ dia
+ 6 inches long
also 6 of 3½ dia + 2 inches long

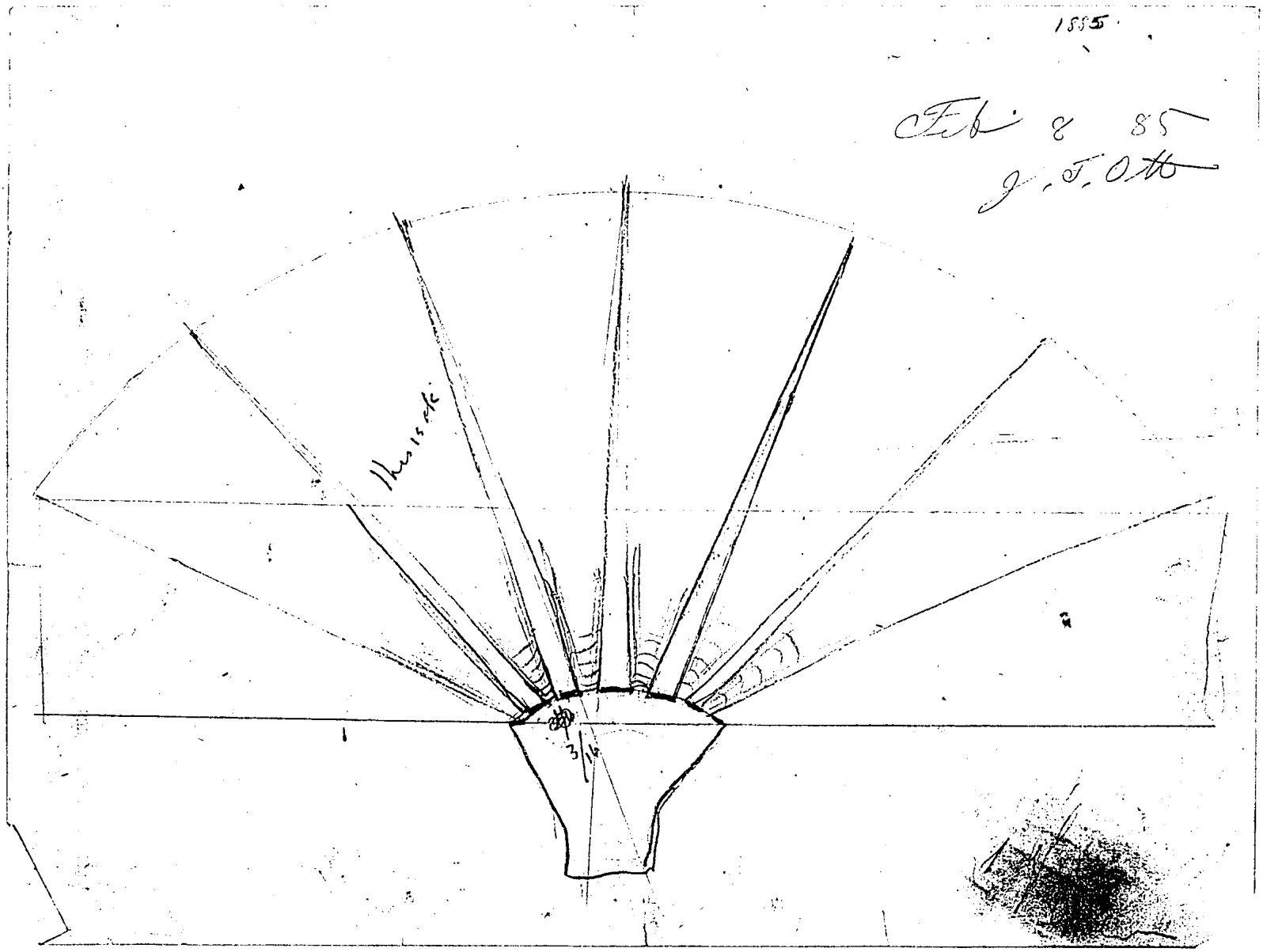
Also 6 of the largest size that can be got into the vacuum bulb

Pat 262

1855

Feb 8 85

J. F. Otto



THOMAS A. EDISON,
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No. 65 FIFTH AVENUE.
NEW YORK.

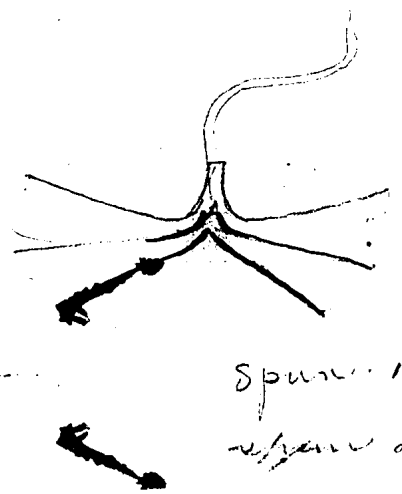
Address reply to.....

Form M.

W. D. RICH,
SUP'T OF CONSTRUCTION.

Feb 9 1885

J. F. Ott



Spun 10 inch
square of thin brass

THOMAS A. EDISON,
NO. 65 FIFTH AVENUE.

NEW YORK, 25 april 1885

John

Have been experimenting on recording in Mallograph fine weight of wire 10/1000 resting on sequin paper giving splendid mark. Shall have little Mercury Cup made of iron into which a globule mercury is placed have a pin about 1/32 dia put in middle extending above mercury then make iron marking wire bend end around so it fits the pin rather loose + lays down on the paper on drum of its own weight -
On the End of the long lever put Complete pens with the smallest lost motion between them to move the wire back + forward on the paper Your voice understood by the Chronograph — get this ready by tomorrow night some -

Also get the Mallograph that works the Sounder ready using

Finished